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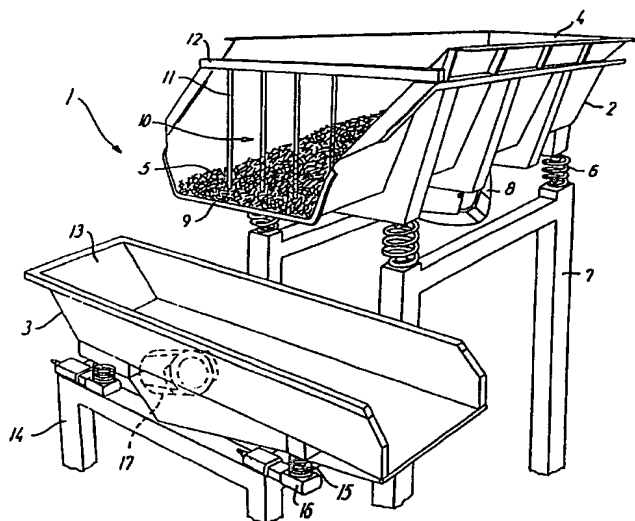
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>5</sup> :</b> <b>B28B 1/52 // B28C 5/40</b> <b>B01F 15/02</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 91/14551</b> <b>(43) International Publication Date:</b> 3 October 1991 (03.10.91)
<b>(21) International Application Number:</b> PCT/DK91/00093 <b>(22) International Filing Date:</b> 27 March 1991 (27.03.91) <b>(30) Priority data:</b> 0788/90 28 March 1990 (28.03.90) DK <b>(71) Applicant (for all designated States except US):</b> SKAKO A/S [DK/DK]; Bygmestervej 2, DK-5600 Faaborg (DK). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> NIELSEN, Niels, Høll [DK/DK]; Louisevænget 7, DK-5270 Odense N (DK). <b>(74) Agent:</b> HOFMAN-BANG & BOUTARD A/S; Adelgade 15, DK-1304 Copenhagen K (DK).		<b>(81) Designated States:</b> AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.  <b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Danish).</i>

**(54) Title:** A METHOD OF DOSING FIBRES**(57) Abstract**

In a method of dosing fibres, such as steel fibres to be mixed in concrete, a supply of fibres (5) is stored in first vibration feeder (2) and is moved from this by means of a second vibration feeder (3). For each dosing operation, a proportioned quantity of fibres (5) is transferred at a stepless rate or a stepwise declining rate from the first to the second vibration feeder (2, 3) while the second vibration feeder (3) stands still. This vibration feeder (3) then transports the transferred fibre quantity further on to the subsequent process while the first vibration feeder (2) stands still. The fibres can hereby be dosed more accurately and uniformly than known before.

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A method of dosing fibres  
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5 The invention concerns a method of dosing fibres, such as steel fibres to be mixed in concrete, and where a supply of fibres is stored in a first vibration feeder and is fed from this by means of a second vibration feeder.

10 Fibres of various types are used today to an increasing degree for i.a. reinforcement of cast materials. Thus, reinforced concrete can be produced by adding steel fibres directly during the actual mixing process, which must then be distributed very carefully and uniformly if the finished concrete is to have the required homogenous and isotropic  
15 properties. However, this has not been possible to a satisfactory degree by means of the conventional dosing methods which tend to feed the steel fibres in the form of more or less tangled lumps.

20 The Danish published publication 153 450 B discloses a method and an apparatus for improving steel fibres which are present in bundles or packed lumps, and which, directionally oriented, are to be dosed to an airborne stream of material, such as a sprayed concrete mass. This  
25 takes place by tearing the bundles or the lumps apart in preferably a rotating drum with inwardly facing pegs, and gradually discharging the loosened steel fibres during the rotation through variable opening in the drum on an inclined chute, where the fibres are replaced by sliding  
30 down the chute under the action of gravity, said chute being constricted in a direction toward the lower end. The fibres now unidirectional are then sucked by a strongly sucking air stream into a pipe stub and further into a transport conduit, in which the unidirectional fibres are  
35 fed in an even flow to the mouthpiece in a spray assembly and are sprayed together with the concrete mass mentioned

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by way of example onto a surface. Tangled fibres can hereby effectively be loosened from each other and be conveyed in an evenly dosed stream with unidirectionally oriented fibres to and be used in e.g. a spray assembly for successive application of fibre-filled concrete on a surface. However, this known method is unsuitable when the fibres are to be used as reinforcement in cast concrete. The reason is that in this case the fibres are to be fed to the concrete mixer evenly and uniformly within a relatively short period of time in a predetermined portion in a loosened, but precisely not unidirectional state.

The object of the invention is therefore to provide a method of the type stated in the opening paragraph by which it is possible to add a predetermined quantity of fibres to a process more accurately and uniformly than known before.

This is achieved in that the method of the invention is characterized in that a quantity of fibres proportioned for a dosing operation is transferred at a stepless rate or a stepwise declining rate from the first to the second vibration feeder while said feeder stands still, and that the second vibration feeder transports the transferred fibre quantity further on while the first vibration feeder stands still. The tangled fibres are hereby loosened from each other during the vibrations already in the first vibration feeder, which can therefore add to the second vibration feeder an evenly distributed layer of loose fibres which can then rapidly and uniformly be introduced into the mixing process at the desired time.

With a view to accurately proportioning the quantity of fibres to be used in each individual case, the fibres can be transferred according to the invention at an initially relatively great rate and in the end phase at a considerably lower rate.

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When the vibrations are generated by electromagnetic vibrators and the second vibration feeder is positioned on electronic weighing cells, dosing may be automatized in an advantageous embodiment of the method of the invention in that the instantaneous amplitude of the vibrations of the first vibration feeder is determined by signals which the weighing cells currently apply to a preprogrammed control unit to which the respective vibrator is connected, and that the vibrator of the second vibration feeder is activated by signal which are applied via the control unit by the process for which the fibres are to be used.

Further, according to the invention, to additionally ensure that tangled lumps do not leave the first vibration feeder, the fibres can be transferred through a net or a grate which is provided on the first vibration feeder at a distance behind its outlet edge substantially transversely to the transport direction of the fibres.

The invention will be explained more fully below with reference to the drawing, whose sole figure shows an advantageous embodiment of a dosing system for performing the method of the invention. This system, which is generally designated 1, comprises a first vibration feeder 2 and a second vibration feeder 3.

The first vibration feeder 2 has a trough 4 with such a great capacity that it can simultaneously serve as a storage silo. The trough 4 is open upwardly and may therefore suitably be filled with fibres 5 from e.g. sacks or cartons (not shown). The trough 4 is placed on a first frame 7 via a first set of springs 6 and is vibrated by means of a first electromagnetic vibrator 8. A grate 10 is provided at a distance behind the outlet edge of the trough, said grate consisting of a plurality of bars 11

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which are suspended from a transverse rod 12.

5 The second vibration feeder 3 has a trough 13 which is positioned transversely below the outlet edge 9 on the trough 4 of the vibration feeder 2. The trough 13 stands on a second set of springs 15 which are supported by a second frame 14 via a set of electronic weighing cells 16. A second electromagnetic vibrator 17 serves to vibrate the second vibration feeder 3.

10 As shown the trough 4 of the first vibration feeder 2 contains a supply of fibres 5. When a quantity of these fibres is to be used for a process, the first vibration feeder 2 is activated via a preprogrammed control unit (not  
15 shown), whereby the vibration feeder 2 initially vibrates fibres into the trough 13 of the vibration feeder 3 at a great rate and finally at a low rate. The entire fibre supply in the first vibration feeder 2 is kept in constant movement during this, so that the tangled structure is  
20 loosened completely, no matter whether the trough is filled completely or is almost empty. The bars 11 of the grate 10 have such a mutual distance that the fibres can only pass the grate when they are not tangled. The fibres will therefore drop out through the grate 10 in a loose state and be  
25 conveyed further on toward the outlet edge 9 in a relatively thin, loose layer.

During the transfer, the transferred amount of fibres is weighed by means of the electronic weighing cells 16, which  
30 currently apply a signal representing the transferred weight to the control unit. When the transfer of the fibres has reached the final phase the control unit, which is programmed accordingly, signals the vibrator 8 to reduce the vibrations so that they correspond to a relatively small  
35 transfer rate. When the entire desired quantity has been transferred, the weighing cells 16 then signal the vibrator

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8 via the control unit to stop the vibrations, and even if these cannot instantaneously be caused to stop, the transferred quantity will nevertheless be metered with a very great accuracy because of the small transfer rate at the  
5 stop time.

During this entire transfer of fibres the second vibration feeder 3 stands still, and the fibres therefore settle as a thin loose layer on the bottom of the trough 13 of this  
10 feeder 3. When the subsequent process is to use the fibres, a signal is applied via the control unit to the vibrator 17 of the second vibration feeder 3, said vibrator 17 then vibrating the second vibration feeder 3 so that the metered quantity of fibres is added uniformly and rapidly to the  
15 process, which may e.g. consist in mixing concrete with steel fibres. During this part of the operation the first vibration feeder stands still, so that no form of material movement simultaneously takes place between the two vibration feeders.

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The system may also comprise several first vibration feeders 2 for their respective types of fibres which may then be added in sequence or blended to the subsequent process.

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P a t e n t   C l a i m s :  
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1. A method of dosing fibres, such as steel fibres, which  
5 are to be mixed in concrete, and where a supply of fibres  
is stored in a first vibration feeder and is fed from this  
by means of a second vibration feeder, c h a r a c t e r -  
i z e d in that a quantity of fibres proportioned for a  
10 dosing operation is transferred at a stepless rate or a  
stepwise declining rate from the first to the second feeder  
while said feeder stands still, and that the second  
vibration feeder then transports the transferred fibre  
quantity further on while the first vibration feeder stands  
still.
- 15 2. A method according to claim 1, c h a r a c t e r -  
i z e d in that the fibres are transferred at an initially  
relatively great rate and in the end phase at a consider-  
ably lower rate.
- 20 3. A method according to claim 1 or 2, wherein the  
vibrations are generated by electromagnetic vibrators and  
the second vibration feeder is positioned on electronic  
weighing cells, c h a r a c t e r i z e d in that the  
25 instantaneous amplitude of the vibrations of the first  
vibration feeder is fixed by signals which the weighing  
cells currently apply to a preprogrammed control unit to  
which the respective vibrator is connected.
- 30 4. A method according to one or more of claims 1, 2 or 3,  
c h a r a c t e r i z e d in that the vibrator of the  
second vibration feeder is activated by signals which are  
applied via the control unit by the process for which the  
fibres are to be used.
- 35 5. A method according to one or more of claims 1 - 4,

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c h a r a c t e r i z e d in that the fibres are transferred through a net or a grate which is positioned on the first vibration feeder substantially transversely to the transport direction of the fibres.

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6. A method according to one or more of claims 1 - 5, c h a r a c t e r i z e d in that the net or grate is positioned at a distance behind the outlet edge of the first vibration feeder.

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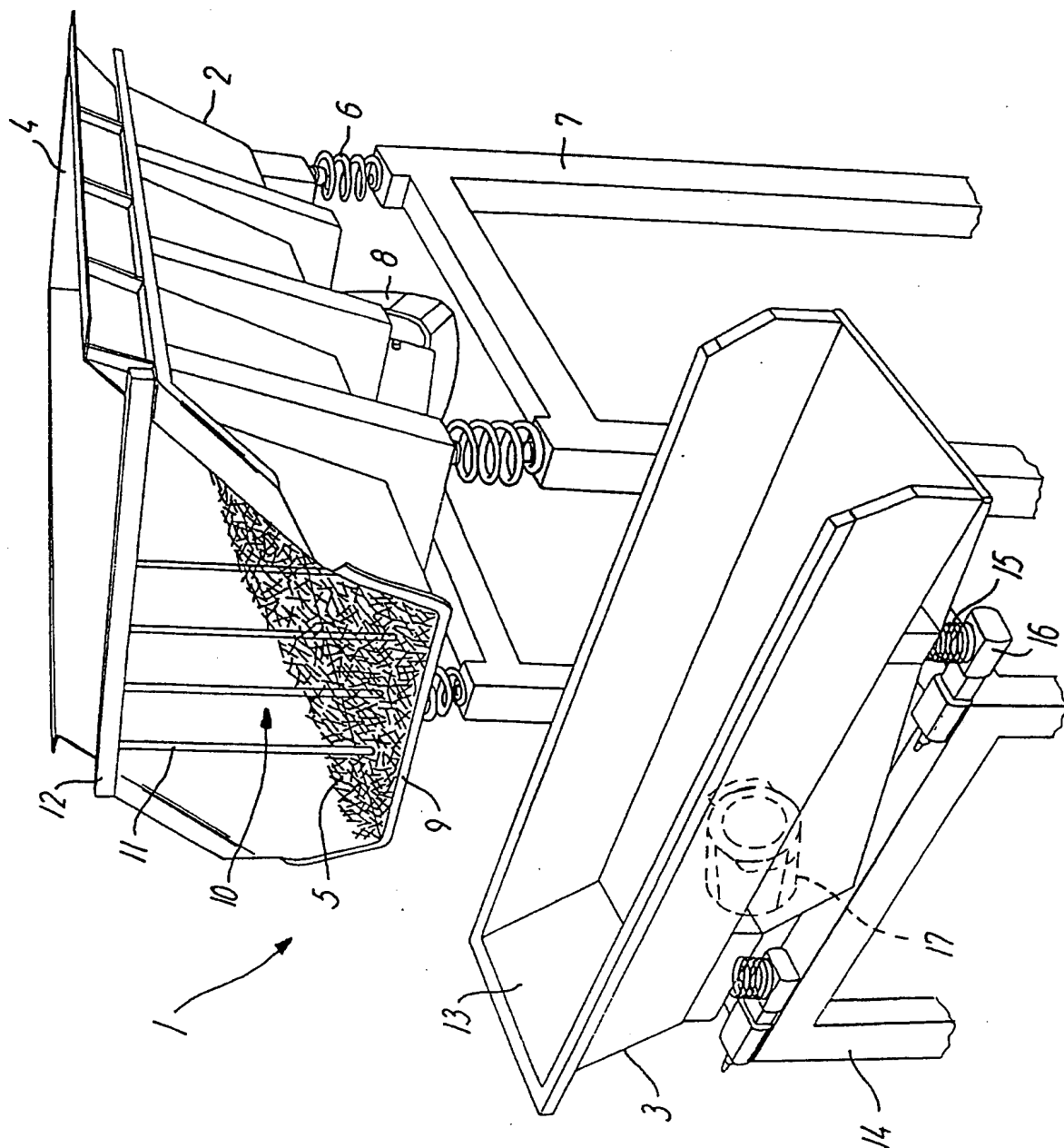
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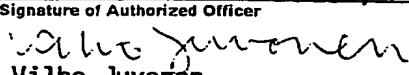
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# INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 91/00093

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B 28 B 1/52 // B 28 C 5/40, B 01 F 15/02		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC5	B 28 B; B 28 C; B 01 F	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched <sup>8</sup>		
SE,DK,FI,NO classes as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	SE, B, 447080 (VERTEX INTERNATIONAL AB) 27 October 1986, see figure 1, detail 3 --	1
Y	US, A, 3638922 (H.G. GUGLIETTI) 1 February 1972, see figure 1, details 16, 17 and 20 --	1
A	DK, B, 153450 (B. SANDELL) 18 July 1988, see claim 1 --	
A	DE, B2, 2337129 (CALEDONIAN MINING CO. LTD.) 1 February 1979, see figure 1, detail 26 --	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents:<sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
12th June 1991	1991-07-01	
International Searching Authority	Signature of Authorized Officer	
SWEDISH PATENT OFFICE	 Vilho Juvonen	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	DE, A1, 2523905 (JÖST GMBH SCHWINGUNGSTECHNIK UND ELEKTROMOTORENBAU) 2 December 1976, see figure 1, details 9, 10 and 11 --	
A	FR, A5, 1288860 (SOCIETE LIGERIENNE ET ORLEANAISE DE MATERIAUX) 19 February 1962, see detail 5 --	
A	FR, A1, 2401005 (P. FOUCAULT) 23 March 1979, see figure 1 --	
A	US, A, 2863651 (R.J. MCBRIDE) 9 December 1958, see figure 1 -- -----	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.PCT/DK 91/00093**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 91-04-30. The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-B- 447080	86-10-27	AU-D- 4544085 EP-A-B- 0221900 JP-T- 61502391 SE-A- 8403237 WO-A- 86/00044	86-01-10 87-05-20 86-10-23 85-12-16 86-01-03
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DE-A1- 2523905	76-12-02	NONE	
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US-A- 2863651	58-12-09	NONE	